



## Report on Jaroslav Keznikl's PhD Dissertation:

### *Dynamic Software Architectures for Resilient Distributed Systems*

#### **Summary**

The PhD dissertation is centered around a set of selected publications where DEECO (Dependable Emergent Ensembles of Components) and its related tools and design methodologies are presented. The starting point are new architecture abstractions specifically thought for designing highly dynamic software architectures that can adapt their behavior according to the observations on the system context. These abstractions are combined in DEECO: a component model that, being equipped with a formal computational model, enables formal analysis of distributed systems. The following tools and methodologies are also presented in the dissertation:

- *jDEECO*, a Java framework providing support for distributed execution of DEECO based applications. Thanks to the integration with Java PathFinder (an execution environment for verification of Java bytecode programs), jDEECO also enables the verification of knowledge-related LTL properties.
- *IRM (Invariant Refinement Method)*, a methodology supporting systematic architecture design of dependable Resilient Distributed Systems. IRM can be used for driving the design from high-level requirements to a DEECO-based architecture in a way that the compliance of design decisions with the overall system goals and requirements is explicitly captured.
- *ARCAS (Automated Resolution of Connector Architectures using constraint Solving)*, a formally grounded method for open-ended design of middleware-based connectors and their automated synthesis at deployment time/runtime.

Finally, DEECO-based software architecture is used to manage adaptive deployment in ad-hoc clouds system. This permits appreciating how DEECO is able to efficiently handle adaptive planning of application-component deployment and migration in ad-hoc clouds.

#### **Structure of the dissertation**

The dissertation is organized in two parts. The first part, consisting of Chapter 1 and Chapter 2, first provides an overview of the presented contributions together with a description of problems tackled in the thesis and the research goals (Chapter 1). Hence, in Chapter 2, a wide description of the state of the art in design and analysis of dynamic software architectures in general and resilient distributed systems in particular is presented. The second part of the dissertation (Chapter 3) consists of a commented collection of six selected publications that contribute to research goals outlined in the first part. Each of the



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considered publication is described via a short summary relating the paper contribution with rest of the dissertation.

Finally, Chapter 4 provides a brief conclusion and highlights possible future research directions related to the area of dynamic software architectures for resilient distributed systems.

### **Evaluation**

The PhD dissertation contains excellent results that positively impact on the different phases of architecture design. This is also witnessed by the high quality of the publications collected in the second part of the dissertation. These publications appeared in five relevant international conferences and in one journal paper.

Both the motivations, at the base of the work reported in the thesis, and the description of state of art, which collocates the proposed results in the context of recent works, are well written. They give to the reader the instruments for assessing the good work reported in the rest of the thesis.

Nevertheless, the choice to present all these interesting results just as a sequence of *collected papers* somehow reduces the quality of the presentation. The short summaries reported before each paper clarify the role of the publications in the research line but are not sufficient to give an organic (and detailed) presentation of DEECo and its related tools. I believe that a reasoned revision of the collected contributions could have increased the quality of the dissertation while providing a complete and self-contained descriptions of the proposed methodologies. However, this is the only weakness I am able to recognize in a excellent PhD dissertation.

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